SPAWAR Systems Center San Diego

Space and Naval Warfare Systems Center, San Diego (SSC San Diego)

ROBOTICS UPDATE

"Providing network-integrated robotic solutions for C4ISR applications."

www.spawar.navy.mil/robots/ Sup 2005 / Vol. 5

Annual Publications Supplement: 2005

"ThrowBot: Design Considerations for a Man-Portable Throwable Robot," **Barnes, M., Everett, H.R., and Rudakevych, P., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.**

The pocket-sized ThrowBot is a sub-kilogram-class robot that provides short-range remote eyes and ears for urban combat. Details on recent evaluation activities performed at the Military Operations in Urban Terrain (MOUT) test site at Fort Benning, GA, are included, along with insights obtained throughout the development of the ThrowBot since its inception by iRobot Corporation in 1999.

"Mobile Robot Knowledge Base," **Barnes, M., Heath-Pastore, T., and R. Hallman., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.**

The Mobile Robot Knowledge Base (MRKB) provides the robotics community with a centralized web-accessible resource for sharing information, experience, and technology to more efficiently and effectively meet the needs of the robotic system user. This resource is available to government, university, and industry robotics personnel at http://www.robot.spawar.navy.mil/.

"Enabling Technologies for Unmanned Protection Systems," **Carroll, D., Harbour, J., Bauer, S., Everett, H.R., Pacis, E.B, Mullens, K., and D. Bruemmer., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.**

In the future, it is envisioned that unmanned air, ground, surface and underwater vehicles will be deployed in an integrated unmanned (and "manned") team fashion to more effectively execute complex mission scenarios. This paper describes joint efforts between SSC and our strategic partners at the Idaho National Laboratory.

"Supporting the Joint Warfighter by Development, Training and Fielding of Man-Portable UGVs," **Ebert, K.A. and B.V. Stratton., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.**

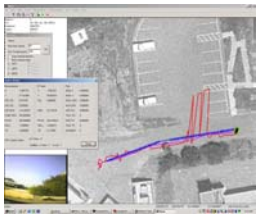
The focus of this paper is on the Robotic Systems Pool and Robotic Systems Combat Support Platoon, and their role as invaluable resources for spiral development in the robotics community by gaining first-hand technical feedback from the warfighter and other users.

"Center of Excellence for Small Robots," **Carroll, D. M., Nguyen, H. G., Laird, R. T., and H. R. Everett., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.**

This paper covers the background, experience, and collaboration efforts of SSC San Diego in serving as the "Impedance-Matching Transformer" between the robotic user and technical communities.

"Applying Unmanned Ground Vehicle Technologies to Unmanned Surface Vehicles," **Ebken, J., Bruch, M., and J. Lum., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.**

Development of unmanned ground vehicles (UGVs) has been ongoing for decades. Much of the technology developed for UGVs can be applied directly to unmanned surface vehicles (USVs) with little or no modifications. SSC Sand Diego has successfully demonstrated this by transitioning technology (both hardware and software) from a man-portable UGV to a USV demonstrator platform.



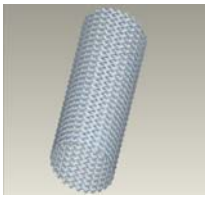
"Advances in Autonomy for Small UGVs," **Bruch, M.,J. Lum.,Yee S.,Tran N., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005**

Many advances have been made in autonomy for unmanned ground vehicles (UGVs) but most of the successes have been for large UGVs, in that the sensors need for autonomy are typically large, heavy and require a significant amount of power. SSC San Diego, in cooperation with the NASA Jet Propulsion Laboratory (JPL), has developed a miniature obstacle-detection sensor suitable for small robots.

"Overview and Highlights of Robotics Research and Development at the Space and Naval Warfare Systems Center, San Diego," **Nguyen, H.G., IDGA Military Robotics, Washington, DC; 19-20 April, 2005.**

A summary of current projects, development approach, research thrusts, technology focus areas, and past efforts within the Unmanned Systems Branch at SSC-San Diego.

Annual Publications Supplement: 2005 (*continued*)

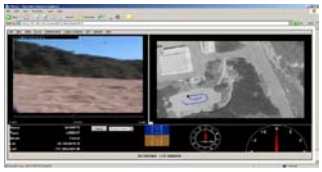


"Intelligent Control of a Highly Flexible Robotic Structure With Hundreds of Motor Elements," Blackburn, M.R.,and Ozcelik., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.

This new robotic architecture possesses a variably compliant structure that allows for the controlled distribution of loads and forces, and for the maintenance of different conformations.

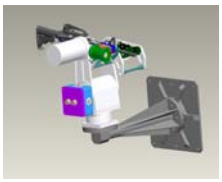
"Integrated Control Strategies Supporting Autonomous Functionalities in Mobile Robots," Sights, B., Everett, H.R., Pacis, E.B., and G. Kogut., Computing, Communications, and Control Technologies Conference, Austin, TX, July 24-27, 2005.

High-level intelligence allows a mobile robot to create and interpret complex world models, but without a optimized control system, the accuracy of the world model and the robot's ability to interact with its surroundings are greatly diminished. As the presence of robots on the battlefield continues to grow, and the trend toward relieving the human of the low-level control burden advances, the ability to integrate the functionalities of several critical control systems on a single platform becomes imperative.



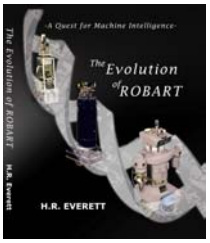
"Unmanned Systems Network-Centric Operations," Nguyen, C., Samuel, R., Nguyen, H.G., Carroll, D., and N. Do., IDGA Future Naval Plans and Requirements West, Coronado, CA, October 25-26, 2005.

This presentation describes SSC San Diego's integration of robotics command and control with the Navy's FORCEnet, which will eventually lead to control of unmanned systems through the global information grid.



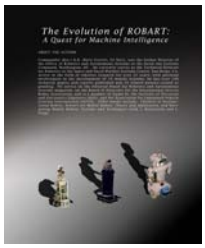
"Target Detection, Acquisition, and Prosecution from an Unmanned Ground Vehicle," Kogut, G., Drymon, L., Everett, H.R., Pacis, E.B., Nguyen, H., Stratton, B., Goree, J., B. Feldman, SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.

Weapon payloads are becoming increasingly important components of unmanned ground vehicles (UGVs), but are extremely difficult to teleoperate. This paper explores the issues involved with automating several aspects of the operation of a remote weapon.



"Chapter 19: Intelligence Revisited," Everett, H.R., (from the forthcoming book: *The Evolution of ROBART)*, October, 2005.

Excerpt : "By 2004 it seemed we had achieved enough truly useful autonomous functionality to where a major reassessment of roles and interactions was clearly in order: the robot was at an evolutionary turning point where it could soon become as big as a part of the team as the human, instead of just an assistive subordinate tool to be used in elective fashion. This realization on our part put things in a whole new perspective… In this chapter we began to explore the theoretical upper limit of robotic intelligence, in terms of a machine's ability to actually think like a human being."

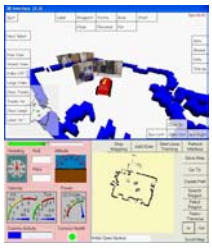


"Chapter 20: The Mind/Mind Problem," Everett, H.R., (from the forthcoming book: *The Evolution of ROBART)*, October, 2005.

Excerpt : "When I design a robot with more than one computer, I certainly don't isolate them in such fashion, as there is so much synergy to be gained by networking them together. Why then would the human body, which so clearly excels in all other areas relative to our most advanced artificial creations to date, take precisely the opposite approach? Pondering this apparent disconnect reactivated a number of mind-related interest areas I'd long found intriguing, but never had much time to pursue, a few of which I will briefly recount below."

***ROBART I: In Retrospect*, Technical Document 3199, Everett, H.R., Space and Naval Warfare Systems Center, San Diego, December, 2005.**

A self-recharging fully autonomous security robot, ROBART I was Bart Everett's thesis project over 25 years ago at the Naval Postgraduate School in Monterey, CA, and one of the very first behavior-based robots ever built. This technical document presents a retroactive look at the design philosophy employed, and the subsequent influence upon many of today's efforts at SSC San Diego.



"Transitioning Unmanned Ground Vehicle Research Technologies," Pacis, E.B, Everett, H.R., Farrington, N., Kogut, G., Sights, B., Kramer, T., Thompson, M., Bruemmer, D., and D. Few., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.

The Technology Transfer project employs a spiral development process to enhance the functionality and autonomy of mobile robotic systems. This paper focuses on particular research areas, such as collision avoidance, simultaneous localization and mapping (SLAM), human presence detection, augmented virtuality.

"Development and Testing for Physical Security Robots," Carroll, D., Nguyen, C., Everett, H.R., and B. Frederick., SPIE Proc. 5804: Unmanned Ground Vehicle Technology VII, Orlando, FL, March 29-31, 2005.

This paper provides an overview and history of the MDARS program and its control station software, with details on the installation and operation at Hawthorne Army Depot. Special attention is given to the MDARS technical development strategy for spiral evolution.

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